4 Watershed Management Goals

Following are the **primary watershed management goals** of OWM for management of its Sudbury land holdings, based on the watershed management principles outlined in Section 3 and the mandates that direct OWM policy:

- **Provide the best possible land cover for protecting reservoir water quality.**
- **Minimize or mitigate both point and non-point sources of water pollution.**

The vast majority of OWM's effort to achieve these goals is focused on lands owned by OWM within the watershed. While land acquisition at Sudbury remains a low priority, an analysis in 1990 identified 350 acres near the reservoirs and the open channel that are high priorities for purchase should funding become available. In addition, OWM continues to support programs that educate and provide technical assistance to owners of non-OWM watershed lands in order to expand watershed protection practices to these lands. In recent years, these programs have included a program to establish forested riparian buffers on private land in the Sudbury drainage.

The following sections identify specific goals for the main areas addressed in this plan: Water Quality and Yields, Land Protection, Forest Management, Wildlife Management, and Cultural Resource Protection.

4.1 Water Quality Goals

- Minimize the long-term cumulative export of phosphorus, nitrogen, and turbidity to the reservoirs.
- Provide a safe supply of water, under emergency conditions, for present and future generations.

There are no drinking water quality regulations pertaining to emergency water supplies and if Sudbury Reservoir was required to be used, heavy chlorination and a 'boil water' order would likely be necessary. The long-term quality of water in the tributaries that flow into the reservoir is a function of geology, soils, topography, vegetation, weather (especially infrequent major floods, hurricanes, fires, etc.), human impacts and wildlife activity. Human and wildlife impacts can also impact water quality over the short-term. The effect of vegetation upon water quality varies with physical basin characteristics, and becomes an important factor in the long-term when the impacts of large, infrequent natural disturbances must be considered. Vegetation cover can also help to ameliorate the negative effects of stormwater runoff from developed land, on heavily developed areas such as Marlborough Brook drainage. Of these factors, OWM management can only affect vegetation and human and wildlife impacts.

It is not within the scope of this plan to include evaluations of current, short-term water quality in the Sudbury Reservoir or its tributaries, except where this is affected by land management or wildlife populations. Human impacts, especially on private lands, that directly and immediately affect the quality of Sudbury Reservoir water are addressed in the 1997 Sudbury Watershed Protection Plan. Pollution sources at the Sudbury watershed include industrial, commercial, and dense residential land uses, nurseries and golf courses, transportation activities, state and federal listed hazardous waste sites,

construction activities, landfills, sand and gravel operations, waterfowl, and permitted point sources of pollution (MWRA/MDC, 1997).

The water quality parameter of primary concern in the Watershed Protection Plan is phosphorus (MWRA/MDC, 1997). Given the undeveloped nature of OWM land, the parameters of primary concern in this plan are turbidity, nitrogen and phosphorus loads, total organic carbon, and pathogens associated with wildlife populations. It is always OWM's preference to maintain tributary water quality as high as possible and in that light, any increases of monitored parameters may be of concern.

4.2 Land Protection Goals

- Limit land uses on OWM lands to those that do not threaten water quality.
- Provide control over non-forest land use on OWM lands (e.g., roads), the effects of natural events (e.g., fire), and human activities that threaten water or other natural resources.
- Limit the disposition of OWM land for municipal or private use, through adherence to the OWM Land Disposition Policy.

An effective watershed management program must address the control of both human-caused and natural impacts on watershed integrity and water quality. Much of this control on OWM watersheds is achieved through the programs and activities of the Environmental Quality section, and thus not directly addressed in this plan. However, various aspects of OWM's Land Management program do directly involve land protection functions.

Control over harmful activities on the Sudbury watershed is best achieved when the Commonwealth has actual ownership or other direct control over allowable activities on the land. While OWM has an active land acquisition program geared towards acquiring ownership of, or other rights on, key parcels on the its active water supply watersheds, such a program has not occurred at Sudbury. An analysis of the effectiveness of a limited land acquisition program is included in Section 5 of this plan.

The location, marking and maintenance of the boundaries of OWM watershed lands are also important land protection activities, since clear boundaries allow for better control over illegal activities that could threaten watershed integrity. Effective resolution of boundary encroachments is also an integral part of boundary maintenance.

The control of potentially harmful activities on watershed lands requires a human presence on those lands, both to identify and locate those activities, and to provide effective enforcement of rules and regulations. This presence is provided both by OWM Rangers and the Massachusetts State Police. This presence allows for the timely discovery and resolution of potentially harmful human activities (e.g., illegal dumping) and natural events (e.g., fires) on the watershed.

Effective monitoring and control also depends on a good road system that allows quick access to all parts of the watershed lands. However, since gravel roads also constitute a source of erosion and sedimentation into streams and water bodies, watershed road maintenance must be done in ways that minimize these potential adverse impacts.

Finally, land protection goals can sometimes be best served through the designation of "Areas of Special Management Restrictions," on which management and other human activities are restricted. Such

designations are especially appropriate on sites where the topography, hydrology, vegetation or other characteristics limit the potential benefits of active management.

4.3 Forest Management Goals

- Provide a vigorous forest cover, diverse in species composition and tree sizes and ages, across the vast majority of OWM lands.
- Maintain forest cover that balances active growth and nutrient assimilation, dense filtration, temperature regulation, and active reproduction.
- Retain this forest cover by encouraging and maintaining adequate forest regeneration across OWM lands.
- Enhance and maintain the ability of the watershed forest to both resist and recover from disturbance.
- Prevent erosion of sediments and nutrients from the watershed forest, and provide for active assimilation of available nutrients.
- Limit the effects of human-caused air pollution by providing cover that filters and/or buffers pollutants.
- Develop a low-maintenance watershed forest, which provides long-term water quality protection with minimal intervention.
- Conduct any forest management activity such that the resulting benefits outweigh any potential negative impacts.
- Comply with or exceed all environmental regulations governing forest management activities in Massachusetts.
- Salvage dead and downed material in areas where this salvage will reduce the threats of fire or nutrient transport, and limit the need for salvage, through deliberate management practices aimed at reducing the likelihood of damage.

OWM has determined that a diverse, vigorous forest cover should be maintained on the vast majority of its holdings, due to the unequaled water quality protection this cover provides. The chief value of this tree cover is to act as a filter for purifying the water that passes through it. The tall crowns of the forest overstory add depth to this filter and provide temperature regulation of surface, ground, and stream waters. Those portions of the forest that are actively growing and assimilating available nutrients limit the export of these nutrients to the reservoir. The forest understory provides uninterrupted recovery from overstory losses. The forest overstory canopy, the forest understory, the vegetative ground cover, and the thick organic mat of decomposing matter on the forest floor, as well as root systems interspersed within the mineral soil below, all work in concert to produce water of high quality.

In order to retain forest cover through the variety of disturbances that affect that cover, it is a OWM goal to expediently establish and retain adequate forest regeneration across the watershed. While the specifics of "adequate regeneration" are addressed later in the plan, OWM believes it is a prudent goal to steadily maintain well-distributed reproduction, so that the forest is capable of quickly recovering from

disturbance. In simple terms, the understory represents a "reserve forest," a back-up to cover the eventuality of overstory losses.

A primary goal of Sudbury forest management is to develop a diversity of age-classes, including well-distributed regeneration, in order to reduce the susceptibility of the forest to catastrophic wind damage. While hurricanes are potentially the most disruptive disturbance facing the Sudbury watershed forest, the more frequent occurrence of less dramatic disturbances is also of concern to managers. These include the effects of air pollution, insects and diseases, and changes brought about by smaller scale weather events such as localized windstorms and heavy snow or ice storms. A forest that is diverse in species composition and multi-aged will resist natural impacts and human-caused pollution because these impacts tend to be species and/or size/age specific. Thus, OWM's forest management will "condition" the forest to be able to recover quickly from both localized, endemic disturbances and widespread, catastrophic events, in part by maintaining diversity.

Producing and retaining a diverse forest cover addresses OWM goal to minimize the export of nutrients and sediments to the reservoirs in a variety of ways. First, this cover reduces the erosion potential of precipitation and minimizes damaging overland flow. It also serves to buffer chemical impacts to water quality by maximizing water contact time with vegetation and soil components. Through the process of evapotranspiration, forests act as water yield "regulators," moderating the potential water yields of watersheds and thereby regulating the loss of nutrients, minerals, and natural elements from the watersheds to the water supply below. Forests that are growing actively accumulate nutrients from the soil, reducing their export to tributaries. Finally, forests likely play an important role in reducing the effects of human-caused pollution such as acid precipitation, heavy metals, and other environmental pollutants by both buffering impacts and by acting as "sinks" for certain pollutants such as lead.

OWM has concluded that the diversity of species appropriate for watershed management purposes should reflect the basic variation in the landscape and natural site conditions (e.g., soils, topography, water, aspect, and slope) found at Sudbury. While a range of tree species may be adequately suited to a given site, the management of species that are unsuited to the site (for example, upland species on wetland sites) does not provide optimal watershed protection. Trees growing off of the sites to which they are physiologically most suited are more susceptible to disease, wind, and other environmental impacts (demonstrated by the declining vigor of many red pine plantations on wet soils). In general, species that are well suited to their sites will grow vigorously over long periods of time, reducing the frequency of mortality and salvage operations. This principle is inherent in the OWM goal to create a watershed protection forest that requires a minimum of maintenance to achieve its function.

It is an OWM goal that any forest management activities on the watershed be conducted in such a way that even if no natural disturbances affect an area, the overall benefits to the resource from the activity still outweigh the potential impacts resulting from the activity itself. All activities have both long- and short-term consequences. In assessing the net costs or benefits of forest management activities, OWM considers both immediate and future impacts. For example, activities such as the cutting and/or removal of trees to deliberately regenerate an area must be controlled such that any short term negative water quality impacts from harvesting will be less than the long term benefits derived from diversifying the forest cover.

When major losses of forest trees occur naturally, it is an OWM goal to salvage dead and downed materials when such salvage will reduce nutrient export and will decrease the risk of catastrophic fires. Further, by reducing the likelihood of damage requiring salvage, and by maintaining good access to forest areas susceptible to damage, forest management should reduce the difficulty and potential water quality threat of these salvage operations.

4.4 Wildlife Management Goals

- Mitigate adverse impacts of wildlife on infrastructure and other watershed resources.
- Protect uncommon, rare, and otherwise significant wildlife species and habitats wherever they exist on OWM lands.
- Assess and mitigate impacts of watershed management activities on wildlife through a process of notification, site visits, review of records and literature, and recommendations to appropriate staff.

The overall goal of the wildlife program on the Sudbury watersheds is to protect important wildlife and their habitats while minimizing or eliminating adverse wildlife impacts on other watershed resources. In certain circumstances, where applicable, active management to enhance wildlife habitat may occur.

Certain wildlife species within the Sudbury watersheds can negatively impact both infrastructure and other critical resources in certain areas. Mitigating these impacts is a top priority.

Although active wildlife management is not a large part of this plan, OWM recognizes that its forest management activities may impact certain wildlife species or habitats. It is an OWM goal to avoid adversely impacting significant wildlife species or their habitats. This will be accomplished primarily through inventory and survey work to locate rare species and habitats, proper coordination with MassWildlife's Natural Heritage and Endangered Species Program, and proper precautions using management guidelines and Conservation Management Practices (CMPs).

While directly protecting rare or endangered wildlife will be a priority, OWM recognizes that its management activities have the potential to impact more common wildlife. Another objective is to assess the impacts of these land management activities on the wildlife communities at the Sudbury, and thereby minimize any adverse impacts. This will be accomplished through long-term monitoring programs and an in-house review process for all planned management activities.

4.5 Biodiversity Goals

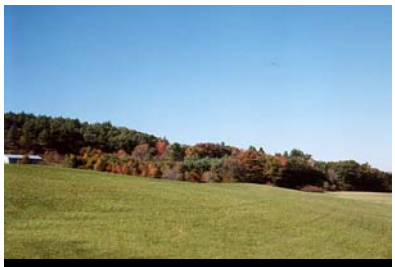
- Maintain an undeveloped, forested condition on most of OWM's land holdings.
- Work to identify all uncommon or rare species present on OWM lands, and provide habitat conditions and levels of protection recommended for perpetuating these species.
- Where feasible and applicable, and on limited acreage, maintain early successional forested and non-forested habitats on OWM lands.
- Work to identify and eliminate invasive species from OWM properties.
- Maintain forest reserves on a portion of OWM's holdings.

OWM's greatest single contribution to regional biodiversity is the maintenance and management of large areas of undeveloped, forested habitat. Forests in general can contribute to soil and water conservation, while providing habitat for a range of indigenous plants and animals, aesthetic values, and

recreational opportunities (Norton, 1999). The protection from development that results from OWM ownership contributes significantly to the long-term viability of a variety of organisms and natural communities.

Rare and uncommon species contribute to the biological complexity of a landscape or region. Efforts to identify and protect rare or endangered species or habitats occur continually on OWM land. Future studies to locate and classify rare natural communities may be initiated. Actions to protect and enhance these species and habitats will provide critical protection of important components of biodiversity.

Across all of its watersheds, OWM owns several hundred acres of non-forested habitat, including abandoned agricultural fields, active and inactive hay fields, and scrub/shrub meadows. On the Sudbury watersheds, OWM owns fewer than 50 acres of non-forested habitat, including 29 acres in the Marlboro filter beds. A majority of these habitats will be maintained in an early successional stage through mowing and/or the use of fire in order to provide habitat for an array of organisms that depend on non-forested areas. As discussed previously, in order to ensure biological representation of indigenous species, a range of habitat conditions must be present. Early successional forested habitat has been clearly identified as a rare habitat type within the state (MassWildlife, pers. comm., Dettmers and Rosenberg 2000). By its nature, early successional forested habitat is dynamic both spatially and temporally. It must either be continually created or maintained at that successional stage or it will mature into older forest. When possible, even-aged management techniques will be used to create and/or maintain this habitat in selected portions of OWM holdings.



FIELD HABITAT

Invasive species are commonly recognized as a major threat to native flora and fauna and biodiversity. In extreme cases, invading exotics can out-compete and exclude native vegetation, resulting in a monoculture of the invasive plant. The result is a tremendous loss of native plant and associated animal diversity. OWM will strive to identify, control and eliminate invasive species from OWM lands, within the limits imposed by water quality protection or limitations of resources and personnel.

The primary reason for incorporating forest reserves into land management planning is to ensure that representative examples of biodiversity indigenous to an area are protected (Norton, 1999). Forest reserves are important because they contribute to the full range of biodiversity and are important to a wide spectrum of species requiring undisturbed habitat. In addition, forest reserves can act as a reference or "control" site in which to assess the impact of management activities. Further, reserves also provide a different aesthetic opportunity and have a different character than managed forests. OWM will assess the feasibility of creating reserves within the Sudbury watersheds, and is in particular looking at the Cedar Swamp area for designating a reserve.

4.6 Cultural Resource Protection Goals

- Identify significant cultural resources on watershed lands.
- Prevent degradation of cultural sites and resources.

Cultural resources are fragile and non-renewable. Once destroyed, they are gone forever. They cannot be regrown, rebuilt or repaired. Similar to endangered and threatened species of flora and fauna, the fragility of these resources places a value on them that is difficult to calculate.

Preservation legislation is designed to ensure that future generations will have the opportunity to understand, appreciate, and learn about the past. DCR's Cultural Resource Management Program is concerned with locating and assessing the condition of both historic and prehistoric cultural resources, and generating plans for protecting those resources that are considered unique or are otherwise significant.

OWM's Cultural Resource Management Program at Sudbury is adapted from a broader plan that was developed for the MDC in 1990. The original plan was articulated in draft form in an MDC document entitled *Cultural Resource Management Plan: Volume One Management Policies, Operating Procedures & Organization*, by then Chief MDC Archaeologist Thomas F. Mahlstedt. The agency plan has been modified to address the specific requirements and nature of the resources contained on watersheds lands under OWM jurisdiction.